



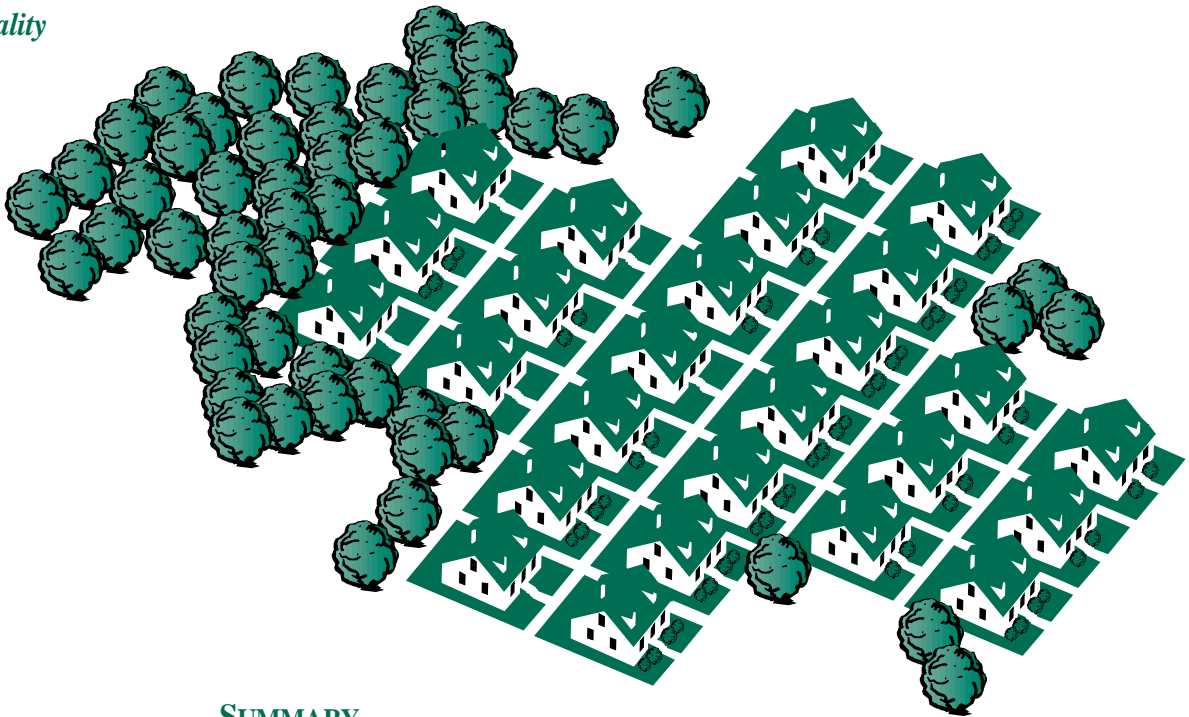
*Linking*

*Land Use to*

*Water Quality*

# Carving up the Landscape

*Habitat Fragmentation and What to Do About It*



## SUMMARY

*The rise of suburban sprawl as the prevalent development pattern in America has resulted in extensive disruption, or fragmentation, of the landscape. Fragmentation reduces the diversity of wildlife, contributes to the degradation of water resources, and impacts community character. Retaining the environmental, social and economic benefits of unfragmented open land requires a strategy that combines natural resource-based community planning and design, land conservation, and wise management of both developed and natural areas.*

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## WHAT IS FRAGMENTATION?



As development occurs, elements like roads, houses, railways, parking lots and utility lines divide the natural landscape into ever-smaller pieces, or fragments. Natural habitat areas are reduced in size and quality, and native populations of plants and animals decline. Some of the more sensitive species disappear. Compared to the obvious damage of a filled wetland or a clear-cut forest, the effects of fragmentation are subtle. However, we have begun to realize that “everyday” development can disrupt and degrade ecosystems even where substantial natural lands remain.

Every type of animal or plant has certain requirements to “make a living” — key elements like food, water, and shelter needed for survival. The minimum area required to provide these needs and the amount of human disturbance that can be tolerated within this area vary widely by species, and are subject to much scientific scrutiny. As research continues, it is becoming clear that for many types of wildlife, it's not the total acreage of habitat that counts, but how much of that habitat exists in large, undisturbed tracts.

## SO WHAT?

Does it really matter if you haven't seen a warbler in your neighborhood lately, or if there are no more otter or bobcats in the woods? The answer is yes. Biological diversity is a measure of both our natural wealth and health, and a certain level of it is essential for our environment to function. If too much diversity is lost, the food web breaks down and an ecosystem becomes unable to renew itself: its species, its soils, and its habitats. Natural processes like decomposition and nutrient cycling, upon which we all depend, begin to break down.

Fragmentation also impacts water resources. Nonpoint source pollution, carried by runoff from developed areas into watercourses and wetlands, is now the number one water quality problem in the country. As development occurs, pavement and other impervious surfaces disrupt the water cycle, channel pollutants into waterways, and otherwise contribute to the degradation of our water resources (*NEMO fact sheet #2 and #3*). Suburban sprawl, the post-World War II pattern of development founded on automobile transportation, creates more impervious surfaces and eats up more open space than more compact styles of development (*NEMO fact sheet #9*).

Natural resources are not the only thing affected as the landscape is transformed from green to gray. The homogenizing effects of sprawl wreak havoc on community character, as strip malls replace traditional village or urban centers. Furthermore, studies from around the country indicate that sprawl is costly, while other studies show that open space is important both to the economic and social health of a community. Public opinion surveys consistently highlight the importance of natural lands, clean drinking water and healthy waterways to citizens.

### FRAGMENTATION IMPACTS

- *habitat destruction*
- *critical changes to vegetation and hydrology*
- *increased predation by domestic animals*
- *increased access for other predators*
- *barriers to wildlife movement*
- *road kill*
- *health effects caused by pesticides and other pollutants*
- *behavioral effects caused by noise, lights, and other disturbances*

Also available:

**NEMO Fact Sheet #1:**

*Project Brief*

**NEMO Fact Sheet #2:**

*Nonpoint Source Water Pollution*

**NEMO Fact Sheet #3:**

*Impacts of Development on Waterways*

**NEMO Fact Sheet #4:**

*Strategies for Coping with Polluted Runoff*

**NEMO Fact Sheet #5:**

*How to Get Started: Protecting Your Town from Polluted Runoff*

**NEMO Fact Sheet #6:**

*Asking the Right Questions: Raising the Issue of Polluted Runoff at a Public Meeting*

**NEMO Fact Sheet #7**

*Reviewing Site Plans of Stormwater Management*

**NEMO Fact Sheet #8**

*They Can't Do That (Can They?!)*

**NEMO Fact Sheet #9**

*Conservation Subdivisions*

## HOW DOES FRAGMENTATION WORK?

Fragmentation can have many different impacts on native species (see box). For instance, as wooded areas shrink, forest birds like the cerulean warbler, which build nests on or near the ground, become susceptible to housecats and other suburban predators. Similarly, amphibian populations decline as ponds and vernal pools become surrounded by developed areas. Research in southern New England suggests that to survive, frogs and salamanders need undisturbed woodland contiguous to their aquatic habitat. For these small species even minor aspects of development can have a major impact — road curbs, for example, can serve as barriers preventing movement to and from vernal pools (*See Figure 1*).

Fragmentation also affects large mammal and bird species. Large predators needing sizeable hunting ranges, like bears, bobcats, and owls, seem most affected. Some species are so adaptable to human landscapes that they make generalizations difficult; for instance, deer populations in southern New England are at record highs. Even this gain may be connected to fragmentation, since most experts believe that the deer explosion is due, in part, to the absence of large predators (including human hunters). Fragmentation can also directly affect human health; for instance, most experts believe that Lyme disease,



Figure 1: What constitutes fragmentation is highly species-dependent. A power line may be a barrier to forest birds, while a salamander's eye view of fragmentation might be a simple road curb.

carried by the “deer” (wood) tick, has spread as deer populations have grown.

The toll of disappearing species is mounting. While our understanding is incomplete, it’s generally true that the wildlife base dwindles as the average size of natural parcels decreases (*Figure 2*).

## WHAT CAN BE DONE?

In the past 30 years, much of New England has actually experienced a growth in wooded areas, as unused farmland reverts to forest. This has allowed animals like moose, fisher, and even bear to return to some areas they had long abandoned. So, it is possible that some species of wildlife can make a comeback, if given the opportunity in the form of suitable habitat. However, the landscape conversion now taking place — that of forest and field to developed land — entails more permanent changes from which recovery is unlikely, if not impossible.

Development will continue, but we can do a much better job guiding how and where development occurs. Minimizing fragmentation requires an approach that combine several overlapping strategies:

1. natural resource-based community planning and design;
2. land conservation;
3. wise management of both conservation land and developed land.

## STRATEGY #1: NATURAL RESOURCE-BASED LAND USE PLANNING & DESIGN

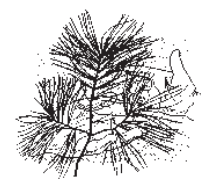
Comprehensive, natural resource-based community planning is the most effective way to combat fragmentation. Natural resource-based planning typically involves these steps:

- conducting a natural resource inventory;
- reaching consensus on priority natural resources on which to focus protection efforts;

- directing development (through town plans and zoning regulations) to areas where it has the least impact on priority natural resources.

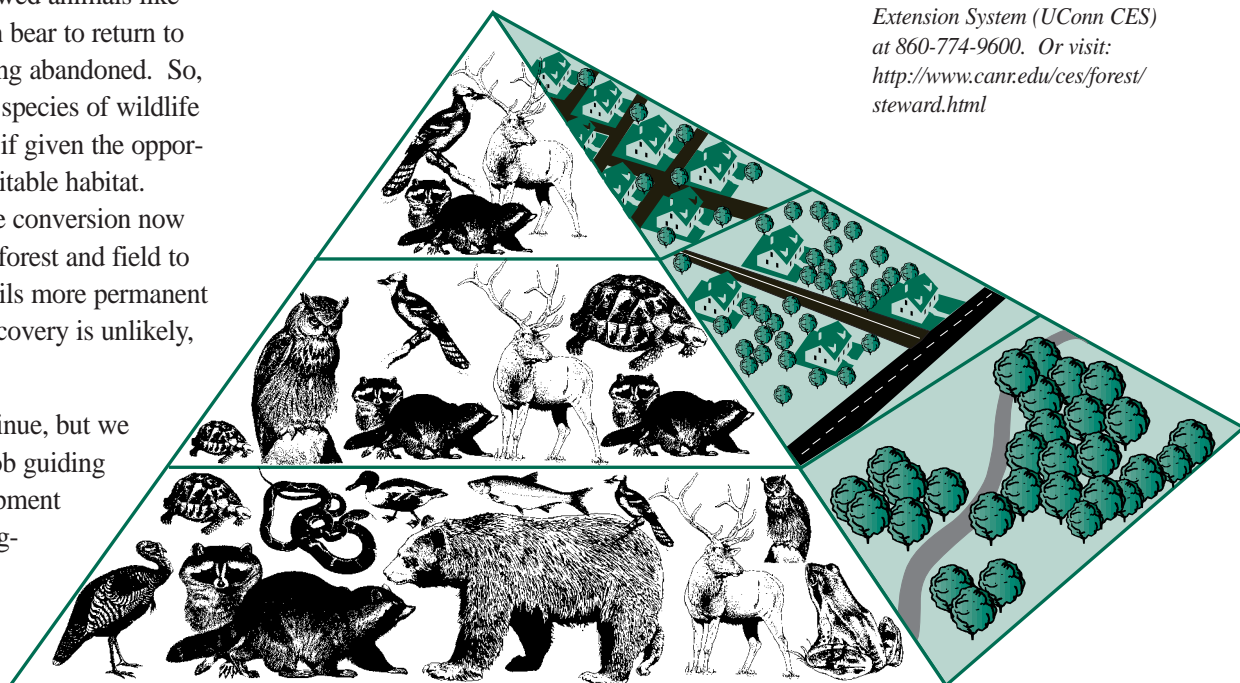
Unlike traditional development-driven planning, natural resource-based planning considers the long-term economic and environmental health of the community (*NEMO Soapbox Editorial #3*).

An open space plan identifying community goals, uses, and funding for open space preservation is a critical component of the natural resource-based planning approach



## FOR MORE INFORMATION

The University of Connecticut Forestry Program educates forest owners on managing forest and wildlife resources, and on methods for long term protection of their lands, including estate planning. Call the University of Connecticut's Cooperative Extension System (UConn CES) at 860-774-9600. Or visit: <http://www.canr.edu/ces/forest/steward.html>



*Figure 2: In general, as “patch size” of unfragmented land decreases, so does the diversity of native wildlife (species shown are for illustrative purposes only).*

(*UConn CES Open Space Packet*). In Connecticut, Planning Commissions and Conservation Commissions need to take the lead in municipal open space planning. Planning Commissions should see that the town Plan of Conservation and Development includes or references an open space plan. The enabling legislation for Conservation Commissions charges them with conducting natural resource inventories and advising other land use boards in their towns on conservation of priority resources; this mandate makes Conservation Commissions the ideal group to provide leadership in open space planning, particularly in the context of a regional approach where inter-town



cooperation is needed. Local land trusts can be key players as well. Although land trusts are private organizations, they can provide leadership and expertise to municipal open space planning efforts.

As noted, good natural-resource based planning addresses where development should occur and what type of development is desired. Zoning and subdivision regulations then implement plan goals, including design elements that can reduce fragmentation. At the neighborhood level, for instance, conservation or cluster subdivisions can help to conserve open and sensitive areas like wetlands, wildlife corridors, and agricultural fields (*NEMO fact sheet #9*). On the individual site level, design elements that reduce impervious surfaces, retain natural vegetation, protect riparian corridors, and make use of vegetated stormwater systems help to reduce fragmentation and support wildlife populations, while serving to protect water quality.

## STRATEGY #2: LAND CONSERVATION

Permanent conservation of land — both private and public — constitutes a major portion of any strategy to preserve open space and minimize fragmentation. It's beyond the scope of this fact sheet to review conservation mechanisms (*see Open Space packet*). However, below are a few general concepts regarding open space and fragmentation that are important when considering conservation priorities.

### ***Conservation Objective #1: Protect a few large tracts of natural land.***

For biodiversity, bigger is better. Ecologists tell us that we need to maintain relatively large areas of continuous, unfragmented natural lands with a diversity of habitat types — grassland, shrubland, and forest. This may seem like a tall order, but it's still achievable in many parts of the country. You might be surprised to learn how much conservation land already exists in your area.

To ensure the protection of sensitive species, you need a lot of unfragmented land. Research in southern New England, for example, shows that forest interior birds

seem to require a minimum of 1500 acres, while 5000 acres or more is ideal. This may be an extreme example, but even tracts this size may be possible to protect when you take a regional view, such as a watershed perspective. By building partnerships and combining forces with neighboring counties, towns, state and federal agencies, and non-profit organization, it may well be possible to protect large land blocks in perpetuity.

### ***Conservation Objective #2: Protect a network of smaller tracts.***

Experts also suggest that we need a scattering of moderate size natural areas, in the 125 to 500 acre range. These "satellite" preserves can support species that don't need really large forests in which to breed, and may even support small populations of the more sensitive species. Wildlife from these satellite areas can repopulate the larger tracts should something catastrophic happen there. Ideally, these smaller tracts of land should be as close as possible to any larger tracts, contain a diversity of habitat/landscape types, and be connected to other natural areas (*see below*). As tracts decrease in size, their shape can become an important factor. Most biologists agree that straight-line boundaries encourage harmful "edge effects" that include predation and competition from generalist species. Gradual, nonlinear transitional edges help to minimize these impacts.

### ***Conservation Objective #3: Make connections.***

Isolated pockets of natural lands are of value to the community, but to maximize ecological value it's important to connect open space wherever possible. Parcels contiguous to existing large and medium-sized tracts should be given high priority for conservation. Stream valleys and ridge tops also should be targeted — these areas often do "double duty," serving as both critical habitat and wildlife corridors. Riparian (streamside) corridors, for example, are used by almost 70% of all vertebrate species. Protected land in riparian corridors should include banks and floodplain areas, as well as contiguous upland forest on at least one side. The width of wildlife corridors is subject to debate, but

*NEMO stands for "Nonpoint Education for Municipal Officials". The NEMO Project offers educational programs on linking land use with water quality, impervious surface reduction, watershed management, open space planning, and homeowner practices to protect water quality.*

*For more information, contact the NEMO Project c/o Chester Arnold, University of Connecticut CES, 1066 Saybrook Road, Haddam, CT 06438-0070 Tel: (860) 345-4511 Fax: (860) 345-3357 Internet: carnold@canr1.cag.uconn.edu.*

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some studies have suggested that corridors must be at least 100 meters in width to maintain at least some “interior” (as opposed to “edge”) conditions.

Small but strategic properties can often be protected through conservation easements or other creative techniques. At the community or regional scale, “greenway” initiatives are obviously good opportunities to make connections.

To make connections, it’s invaluable to see it on a map. This gets back to the value of natural resource inventories, and knowing what you’ve got. Examining a map showing the mosaic of existing open space in your town or watershed, and how it relates to waterways, wetlands, ridgetops and other key areas, is one of the best ways to get a handle on implementing the conservation strategies listed above.

## WISE LAND MANAGEMENT

Property owners (both public and private) can further protect natural resources and minimize fragmentation through management and design, whether their property is in a natural or developed state.

### ***Management Objective #1: Manage conservation lands to provide diverse habitat.***

Not only do we need to add to conservation land, but we also need to manage conservation lands and other property to support key species. Whether natural lands are publicly or privately owned, management usually means making some decisions about what constitutes a “key” species. For instance, birds that live in grassy or shrubby habitats, like the bobolink, eastern meadowlark, and blue-winged warbler, have declined dramatically over the past 30 years as farmland shrinks. To preserve these species, some conservation lands must be managed to create or maintain shrub and grasslands (i.e. clearing, mowing, burning, etc.). On the other hand, some forest species require extensive tracts of undisturbed forest.

The need for a diversity of habitats further underscores the value of having large parcels that can accommodate different landscapes.



*The elusive bobcat near Wildcat Ridge – highly unlikely! How many ironically named subdivisions like this have you seen around your town?*

### ***Management Objective #2: Manage individual properties to provide diverse habitat.***

There are many species that don’t need large forests in which to live. These are species that you may catch glimpses of as you walk through nearby woods, or that may come into your backyard to feed, even if they live in more secluded areas. For these species, such as woodpeckers, many song birds, small mammals and some larger ones, even narrow woodland corridors can provide critical travel routes. As noted, often such pathways are located on ridgetops or along waterways. Permanent conservation of these small but important areas is ideal, but wise management by private landowners can also work. Streamside buffers of natural vegetation, and the use of naturalistic landscaping in these areas instead of lawns, are important contributions that individual homeowners can make. For owners of large forested properties, a forest stewardship plan (see margin on page 6) can help enhance their property’s value to wildlife while accommodating timber harvesting or other economic activities.

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*The Wildlife Conservation Research Center (WCRC) of the University of Connecticut offers a practical means for helping communities and individuals resolve difficult questions on habitat fragmentation and other wildlife issues. Supported by private donations and gifts, WCRC brings the resources of a Land Grant University to bear on wildlife issues. For information call 860-486-5896.*

## BUT WHAT CAN I DO? GET SPECIFIC!

Reducing habitat fragmentation may seem a bit overwhelming for the individual. But there are many things you can do to help, based on the strategies listed above. Here are a few ideas:

- You can contribute time and/or money to land conservation in your area, whether it's accomplished through a local land trust, your town's land use boards, or nonprofit conservation organizations.
- You can ask whether these groups have open space plans. Many towns and local groups simply take any piece of property that comes their way, with no attempt to target critical areas like streamside corridors and areas contiguous to existing open space. Municipal open space plans should prioritize land to be acquired, and address funding mechanisms.
- You can check with your town's Conservation Commission — have they conducted a natural resource inventory, identified priority natural resources, or developed an open space plan? If the answer to these questions is “we’re too busy regulating wetlands to take on new responsibilities,” suggest that the town consider separating their Inland Wetland and Conservation Commissions to allow for more proactive conservation.
- If you own farm or forest land and you wish to preserve it for future generations, you can investigate conservation easements, estate planning, and other tools that can make conservation a economically feasible option.
- You can manage your own property to improve wildlife habitat, employing naturalistic landscaping, stream buffers and other mechanisms. If you are a forest owner, you can implement a stewardship plan. Even if you live on a quarter acre lot in the middle of town, you can grow native, berry-producing shrubs and other plants that are food sources for local wildlife.

- You can ask your local land use boards to rethink their land use plans and regulations to ensure they protect critical natural resources and wildlife habitats. Does your town ask developers to propose open space or conservation subdivisions in key areas? If biodiversity doesn't move them, maybe the mounting list of studies showing the economic benefits of open space will!
- You can volunteer (or run) to serve on a land use board yourself, and have a direct hand in the decisions that shape the future of your town (*NEMO fact sheet #8*).
- You can support wildlife conservation and habitat management programs in local schools.

## CONCLUSION

Fragmentation impoverishes both the natural and human landscapes. Researchers still have much to learn about the effects of habitat fragmentation, but the basic concept is simple — a parking lot can't support a bobcat, nor can a suburban lawn accommodate grassland bird species. Whenever a streamside forest is replaced by manicured lawn, a wildlife corridor is severed and fish habitat is degraded. When forest understory plants are removed to create a park-like appearance, certain plant and animal species may lose their last foothold for miles around. When a large forest is fragmented into house lots, rare songbirds and other deep woods species lose another place to reproduce and thrive. And, as habitat goes, so does water quality and community character. As individuals and communities, we can help to reduce the impacts of fragmentation through a combination of planning, design, conservation, and management.

*The Connecticut Forest Stewardship Program offers technical and financial assistance to private forest landowners in the planning and implementation of wildlife habitat enhancement and other forestland management activities. For information call 1-888-30WOODS or 1-860-345-4511. Or visit: <http://www.canr.edu/ces/forest/>*

*This fact sheet was written by Chester Arnold, UConn CES, Rosemary Monahan, EPA Region One, and Stephen Broderick, UConn CES. Printed March 1999.*

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